23MCU205

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2025
(Second Semester)

Branch – **MATHEMATICS WITH COMPUTER APPLICATION**

ANALYTICAL GEOMETRY OF 3D AND VECTOR CALCULUS

Time: Three Hours Maximum: 75 Marks

SECTION-A (10 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** marks (10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	The equation of the plane making intercepts a, b, c on the axes OX, OY, OZ respectively is _____ a) $ax + by + cz = 1$ b) $a/x + b/y + c/z = 1$ c) $x/a + y/b + z/c = 1$ d) $a/x + b/z = c$	K1	CO1
	2	The length of the perpendicular from the point (x_1, y_1, z_1) on the plane $ax + by + cz + d = 0$ is a) $\pm\frac{(ax_1 + by_1 + cz_1 + d)}{\sqrt{(a^2 + b^2 + c^2)}}$ b) $\frac{\pm(ax_1 + by_1 + cz_1)}{\sqrt{(a^2 + b^2 + c^2)}}$ c) $\pm\frac{(ax_1 + by_1 + cz_1 + d)}{\sqrt{(a + b + c)}}$ d) $\frac{(ax_1 + by_1 + cz_1 + d)}{3abc}$	K2	CO1
2	3	The equation of a straight line passing through two given points (x_1, y_1, z_1) and (x_2, y_2, z_2) is a) $(x - x_2)/(x_2 - x_1) = (y - y_2)/(y_2 - y_1) = (z - z_2)/(z_2 - z_1)$ b) $(x - x_1)/(x_2 - x_1) = (y - y_1)/(y_2 - y_1) = (z - z_1)/(z_2 - z_1)$ c) $x/(x_2 - x_1) = y/(y_2 - y_1) = z/(z_2 - z_1)$ d) $(x - x_2)/x_1 = (y - y_2)/y_1 = (z - z_2)/z_1$	K1	CO2
	4	To determine a straight line _____ geometrical conditions are necessary. a) 2 b) 3 c) 4 d) 5	K2	CO2
3	5	The radius of a sphere whose equation is $x^2 + y^2 + z^2 + 2ux + 2vy + 2wz + d = 0$ is a) $\sqrt{(u^2 + v^2 + w^2 - d)}$ b) $\sqrt{(u^2 + v^2 - w^2 - d)}$ c) $\sqrt{(u^2 + v^2 - w^2)}$ d) $\sqrt{(u^2 + d - v^2)}$	K1	CO3
	6	Intersection of two spheres is a a) Straight line b) Circle c) Triangle d) Parabola	K2	CO3
4	7	A _____ region in the plane is a connected region D such that every simple closed curve in D encloses only points that are in D. a) Loop b) Simply connected c) Multiply connected d) Punctured region	K1	CO4
	8	If ϕ is a function of three variables that has continuous second-order partial derivatives then: a) curl $(\nabla\phi)=0$ b) curl $(\nabla\phi)=a$ c) $\nabla^2\phi=0$ d) $\nabla^2\phi=C$	K2	CO4
5	9	A parametric representation for the cylinder, $x^2 + y^2 = 4, 0 \leq z \leq 1$, is _____ where $0 \leq \theta \leq 2\pi$ and $0 \leq z \leq 1$. a) $x=2\cos\theta, y=2\sin\theta, z=z$ b) $x=\cos\theta, y=\sin\theta, z=\theta$ c) $x=2\cos\theta, y=\sin\theta, z=\tan\theta$ d) $x=3\cos\theta, y=2\sin\theta, z=z$.	K1	CO5
	10	$\int_C F.dr =$ _____ a) $\int_S curl\, F.ds$ b) $curl \int_S F.ds$ c) $\iint_S curl\, F.ds$ d) $curl \iint_S curl\, F.ds$	K2	CO5

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SECTION - B (35 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Find the equation of the plane passing through the points (3,1,2), (3,4,4) and perpendicular to the plane $5x + y + 4z = 0$.	K3	CO1
		(OR)		
	11.b.	Find the equation of the plane through the line of intersection of the planes $x + y + z = 1$, $2x + 3y + 4z - 7 = 0$ and perpendicular to the plane $x - 5y + 3z = 5$.	K3	CO1
2	12.a.	Find the perpendicular distance from the point (3,9,-1) to the line (x+8)/-8 = (y-31)/1 = (z-13)/5.	K2	CO2
		(OR)		
	12.b.	Find the condition for the lines $ax+by+cz+d = 0 = a_1x + b_1y + c_1z + d_1$, $a_2x + b_2y + c_2z + d_2 = 0 = a_3x + b_3y + c_3z + d_3$ to be coplanar.	K2	CO2
3	13.a.	Find the equation to the sphere through the four points (2,3,1), (5,-1,2), (4,3,-1), (2,5,3).	K3	CO3
		(OR)		
	13.b.	Show that the plane $2x - y - 2z = 16$ touches the sphere $x^2 + y^2 + z^2 - 4x + 2y + 2z - 3 = 0$ and find the point of contact.	K3	CO3
4	14.a.	Evaluate $\int_C ydx + zdy + xdz$, where C consists of the line segment C_1, from (2,0,0) to (3,4,5), followed by the vertical line segment C_2 from (3,4,5) to (3,4,0).	K4	CO4
		(OR)		
	14.b.	If $F(x,y,z) = y^2i + (2xy + e^{3z})j + 3ye^{3z}k$, find a function f such that $\nabla f = F$.	K4	CO4
5	15.a.	Evaluate $\iint_S F.ds$, where $F(x,y,z) = yi + xj + zk$ and S is the boundary of the solid region E enclosed by the paraboloid $z = 1 - x^2 - y^2$ and the plane $z = 0$.	K4	CO5
		(OR)		
	15.b.	Find the flux of the vector field $F(x,y,z) = zi + yj + xk$ over the unit sphere $x^2 + y^2 + z^2 = 1$.	K4	CO5

SECTION -C (30 Marks)

Answer **ANY THREE** questions

ALL questions carry **EQUAL** Marks (3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Find the equation of the plane passing through the points (2,-5,-3), (-2,-3,5), and (5,3,-3)	K4	CO1
2	17	Find the locus of the mid-points of lines whose extremities are on two given lines and which are parallel to a given plane.	K4	CO2
3	18	Find the condition that the line $\frac{x-a}{l} = \frac{y-b}{m} = \frac{z-c}{n}$ where $l^2 + m^2 + n^2 = 1$ should touch the sphere $x^2 + y^2 + z^2 + 2ux + 2vy + 2wz + d = 0$. Show that there are two spheres through the points (0,0,0), (2a,0,0), (0,2b,0) which touch the above line and that the distance between their centers is $\frac{2}{n^2}[c^2 - (a^2 + b^2 + c^2)n^2]^{1/2}$.	K4	CO3
4	19	State and prove Greens theorem.	K4	CO4
5	20	Evaluate $\iint_S z.ds$, where S is the surface whose sides S_1 are given by the cylinder $x^2 + y^2 = 1$, *whose bottom* S_2 *is the disk* $x^2 + y^2 \leq 1$ *in the plane* $z = 0$ *and whose top* S_3 *is the part of the plane* $z = 1 + x$ *that lies above* S_2.	K4	CO5

Z-Z-Z END